

### 3.4 Rivers and Streams Drinking Water Designated Use Assessment

**Drinking Water Designated Use Subgoal:** Protect and insure adequate ground and surface water quantity for drinking water use.

All surface waters in NJ are designated as drinking water supplies under the NJ Surface Water Quality Standards (N.J.A.C.7:9B). There are 54 potable surface water supply intakes in the state, mostly clustered in northern NJ and many of these intakes are located on reservoirs. (See Figure 3.4-1 and Appendix A3.4-1.)

This Water Quality Inventory Report provides the first assessment of drinking water designated uses. This assessment provides an overview of finished drinking water quality, water quality in current source waters and water quality in surface waters that are designated as potable supplies but are not currently used for that purpose.

#### 3.4.1 Rivers and Streams Drinking Water Designated Use Assessment Method

Ideally the Drinking Water Designated Use assessment should consider:

- Drinking water quality
- Water quality in current source waters
- Water quality in surface waters that may be used as drinking water sources.

***Drinking Water Quality:*** Drinking water quality provided by water purveyors has been summarized as an environmental indicator for NEPPS. (NJDEP, 2000). This indicator provides excellent information regarding the quality of finished drinking waters, which are regulated for many constituents under Federal and State Safe Drinking Water Acts. In addition, New Jersey's Safe Drinking Water Act provides additional protection through the regulation of 28 constituents that are either not regulated under the Federal Safe Drinking Water Act or are regulated at lower concentrations in New Jersey.

However, there are some limitations to the finished drinking water environmental indicator. The indicator currently does not include information regarding the source of water (i.e., surface or ground water or a combination). Further, the indicator does not include information regarding the level of treatment required to meet the Federal and State Safe Drinking Water Act standards. Some facilities provide additional treatment to remove contaminants in source waters. These information needs will be addressed through the Source Water Assessment Program.

***Source Water Assessment Program (SWAP)*** Under SWAP, New Jersey will delineate areas which have the potential to influence waters (surface and ground) serving as public drinking water sources (NJDEP, 1998). Within these areas, the state will identify the origins of a wide range of contaminants and identify the vulnerability of the water systems to these contaminants. The SWAP will delineate waters requiring only conventional treatment (coagulation, sedimentation and filtration,) and those requiring additional treatment methods. The program will also delineate sources at risk in the future.

***Water Quality in Current Source Waters*** The Ambient Stream Monitoring Network (ASMN) provides data for surface water quality in New Jersey. The ASMN is described in Part III, Chapter 3.1. Only 4 of 81 ASMN stations are located near potable supply intakes: the Saddle River at Lodi monitoring station is near Haworth Water Supply Intake; Passaic River at Little Falls monitoring station is near Passaic Valley Water Commission Water Supply Intake; Matchaponix Brook at Spotswood is near United Water- Matchaponix Water Supply Intake; Delaware River at Trenton monitoring station is co-located with the Trenton Water Company Water Supply Intake. As discussed above, additional information regarding source water quality will become available through SWAP.

Nitrate was chosen as an indicator of Drinking Water Designated Use Attainment because it is difficult and expensive to remove from potable supplies. To protect against adverse health effects, nitrate is regulated at 10 ppm in the Federal and State Safe Drinking Water Act regulations and New Jersey Surface Water Quality Standards. The SWQS in the Pinelands was set at 2 ppm to protect the unique ecology of this area.

***Water quality in surface waters that may be used as drinking water sources*** This assessment was based on 1254 nitrate samples collected at 81 stations between 1995 and 1997 through the Cooperative Ambient Stream Monitoring Network and trends assessment between 1986 and 1995 (USGS, 1999). These information sources were described in Section 3.1: Water Quality. The Drinking Water Designated Use Assessment for nitrate in rivers and streams was conducted as follows:

<b>Table 3.4.1-1: Water Quality Data Assessment Method</b>	
Full Support	Less than 10% of samples exceed applicable SWQS
Full Support but Threatened	Less than 10% of samples exceed applicable SWQS, but declining WQ trends indicate SWQS are likely to be exceeded in more than 10% of samples within 2 years.
Partial Support	Between 11% and 25% of samples exceed applicable SWQS
No Support	More than 25% of samples exceed applicable SWQS
Notes: From: EPA Guidance for Preparation of Water Quality Inventory Reports, EPA, 1997.	

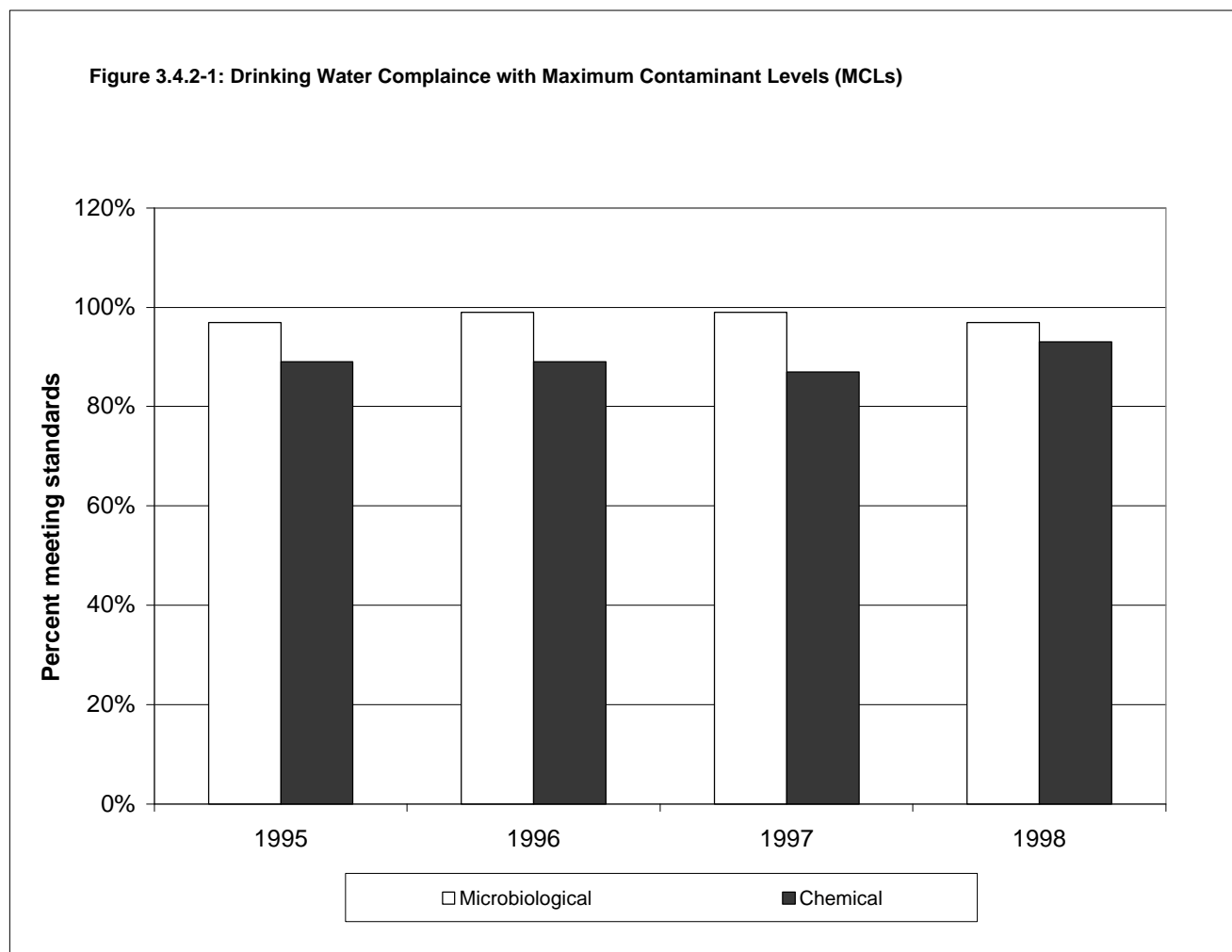
**Spatial Extent of Assessment:** As discussed in Part III, Chapter 3.1, stations in the Ambient Stream Monitoring Network, as operated through 1997, assess 176.38 stream miles.

It is important to note that the monitoring design used to collect these data does not support extrapolating the assessment results to locations or streams that were not monitored. Streams that appeared to have the greatest impacts were prioritized in this network.

### **3.4.2 Rivers and Streams Drinking Water Designated Use Assessment Results**

***Drinking Water Quality*** Finished water from community water systems in this state is of high quality. Environmental indicators developed and reported as part of NEPPS have shown that

since 1995, the number of community water systems in New Jersey that have met all safety standards has remained consistently high - between 97% and 99% for microbiological standards and between 87% and 93% for chemical standards. (NJDEP, in press)



**Water Quality in Current Source Waters** As discussed above, nitrate was chosen as an indicator for source water quality because it is difficult and expensive to remove from drinking water. Results from the ASMN and USGS trends study are summarized for the four ASMN stations located near potable supplies. See Table 3.4.2-1 below.

Average concentrations are significantly below the SWQS and drinking water MCL for nitrate. Thus, a station with a mean of 2 ppm NO<sub>3</sub> in 2000 and a trend of +0.3 ppm NO<sub>3</sub> per year is estimated to have a mean concentration of 2.6 ppm NO<sub>3</sub> by the next NJ Water Quality Inventory Report in 2002. However, elevated maximum concentrations and upward trends indicate that nitrate is an emerging issue for these potable supplies.

**Table 3.4.2-1: Nitrate Status (1995-97) and Trends (1986-95) in Rivers Near Four Potable Supplies**

Potable Intake	ASMN Station	# of River Samples	Average NO <sub>3</sub> in River (ppm)	Max NO <sub>3</sub> in River (ppm)	NO <sub>3</sub> Trends in River (ppm/yr)
Haworth Water Co.	Saddle R at Lodi	15	4.6	9.1	0.16
Passaic Valley Water Commission	Passaic River at Little Falls	44	2.6	7.2	0.27
United Water-Matchaponix	Matchaponix Bk at Spotswood	14	4.5	9.8	NSIG
Trenton Water Company	Delaware River at Trenton	12	0.8	1.5	NSIG
<b>Notes:</b> <ul style="list-style-type: none"> <li>Based on Ambient Stream Monitoring Network data collected near potable supply intakes, not finished drinking water quality.</li> <li>Average and maximum concentrations based on routine quarterly sampling in the ASMN</li> <li>Trends reported by USGS 1999. NSIG - no significant trend</li> </ul>					

NJDEP reported nitrate concentrations in finished drinking waters as an environmental indicator. Between 1993 and 1995, less than 1% of 625 community water systems reported samples with nitrate concentrations above 10 ppm. However, 10-12% of all public water systems reported nitrate concentrations equal to or above 5 ppm between 1993 and 1995 indicating vulnerability to nitrate contamination. (NJDEP, 1998). Note that these results are for both surface and ground water sources.

Through the SWAP program, additional nitrate data collected by water purveyors is expected to become available. These data will be used to better characterize nitrate status and trends at intakes and in finished drinking water quality.

***Water quality in surface waters that may be used as drinking water sources*** Average nitrate concentrations ranged from 0.020 parts per million (ppm) NO<sub>3</sub> to 4.58 ppm and 1 of 1254 samples (0.01%) exceeded the 10 ppm SWQS criterion and drinking water MCL for nitrates. Average NO<sub>3</sub> concentrations for 1995-97 are shown on Figure A3.4.2-1 in the Appendix. Status and trends information is summarized on Table A3.4.2-1 in the Appendix.

One of 13 samples (7.7%) collected at the South Branch of the Pennsauken Creek at Cherry Hill (WMA 18, station # 1467081) exceeded the 10 ppm NO<sub>3</sub> criteria applicable to FW2 Waters. Statistically significant increasing trends in concentration were found at this location. However, mean concentration was below the applicable criteria and trends were small enough to indicate that these waters are expected to continue to fully meet drinking water designated uses.

Statistically significant declining trends in NO<sub>3</sub> concentration were found 11 stations between 1986 and 1995, indicating improving water quality at these locations. No statistically significant trends were found at 44 stations between 1986 and 1995, indicating stable water quality at these locations. Statistically significant increasing trends in NO<sub>3</sub> concentration were found at 24

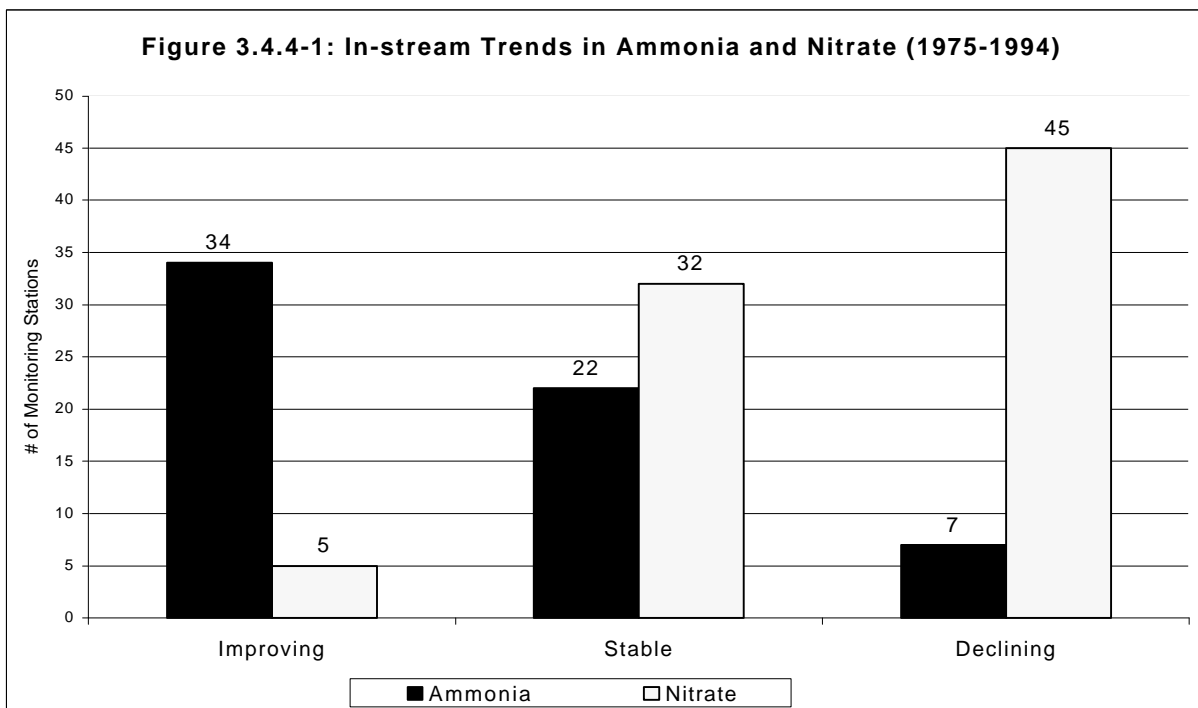
stations between 1985 and 1995, indicating worsening water quality at these locations. However, the rate of change in NO<sub>3</sub> concentrations was small, ranging from 0.01 ppm NO<sub>3</sub> per year to 0.35 ppm NO<sub>3</sub> per year. The trends assessment conducted by USGS indicates that drinking water designated uses, as indicated by nitrate in streams, will continue to be met through 2002.

#### 3.4.4 Drinking Water Designated Use Source and Cause Assessment

A qualitative assessment of nitrate sources is provided below. Both point and nonpoint sources contribute to nitrate rising levels of nitrate. Point sources contribute nitrate through secondary treated effluent while nonpoint sources contribute through the application of fertilizers to lawns and farms and through animal waste. Ground water may also contribute to rising levels in streams, particularly in southern NJ coastal plain as indicated by results from USGS's Long Island - New Jersey National Ambient Water Quality (NAWQA) studies. (Ayers, 2000)

Point Source Assessment: Upgrades of wastewater treatment plants to secondary treatment resulted in statewide compliance with un-ionized ammonia, which is toxic to aquatic life and elevated in primary treated sewage. See the Water Quality Section (Part III, Section 3.1). However, secondary treated sewage contains elevated nitrate.

A comparison of trends in total ammonia and nitrate between 1975 and 1994 using data from the ASMN illustrates the transition to secondary treatment. During this time period, concentrations of un-ionized ammonia decreased at 37 stations (54%), while concentrations of nitrate increased at 46 stations (55%). See Figure 3.4.4-1.



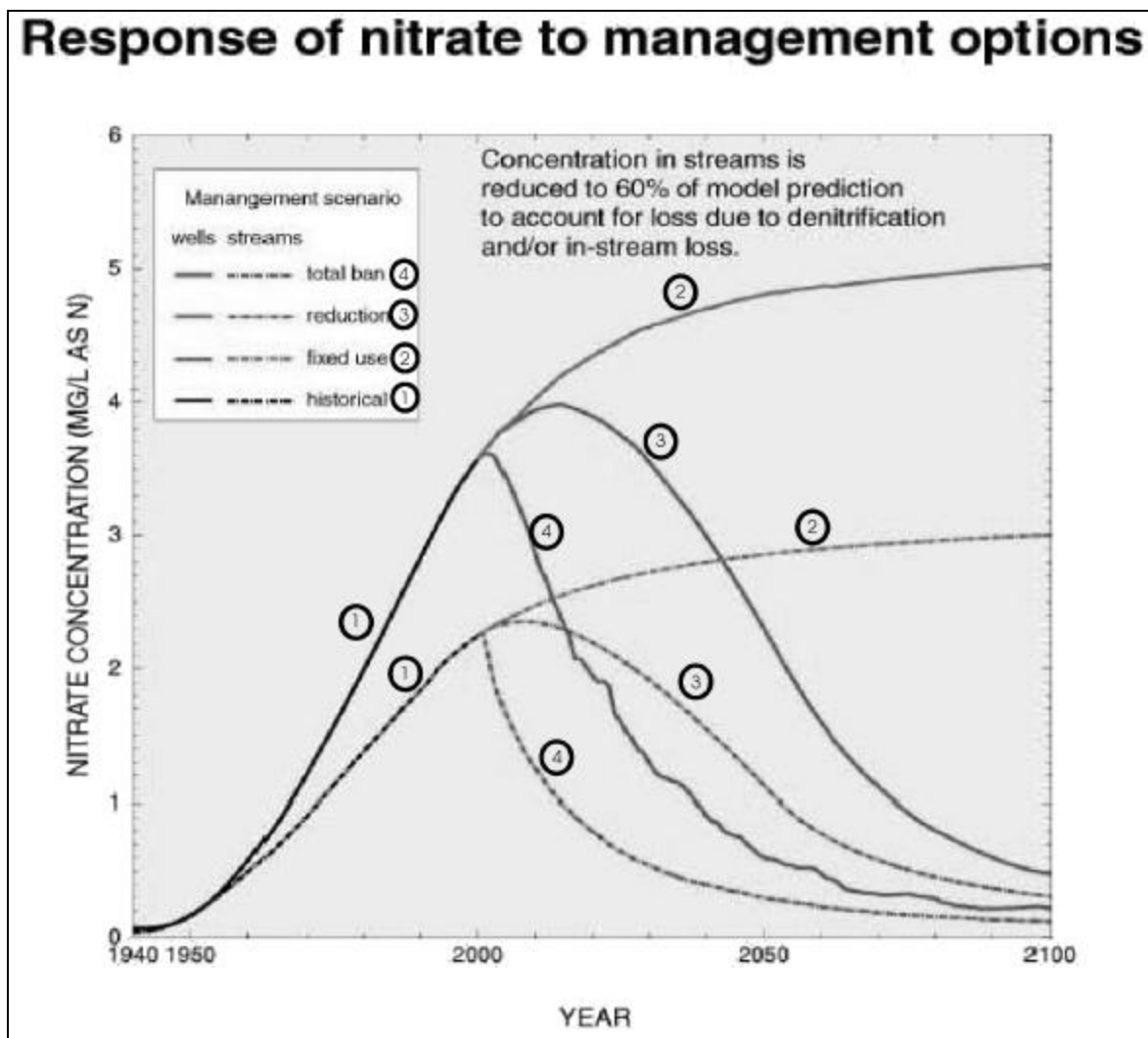
Elevated nitrates in the Hammonton Creek at Westcoatsville have been attributed to the Hammonton Sewage Treatment Plant. An Environmental Infrastructure Trust loan has been awarded to remove this discharge from the stream and divert it to ground water. The project is ongoing and expected to be completed by March, 2001.

Nonpoint Source Assessment: Nitrates have been applied to land surfaces as fertilizers for agricultural purposes and lawns. Low concentrations of nitrate also arise from forests. Nitrates that are not used by plants (crops or lawns) travel through the soil to surficial aquifers, deeper ground water and streams. In the sandy NJ coastal plain, these fate and transport processes are well understood and can be modeled. Predictive modeling provides a useful tool to estimating future surface and ground water quality under various management scenarios.

Under the Long Island- New Jersey National Ambient Water Quality Assessment (NAWQA) program, nitrate concentrations in ground water and streams were predicted for the NJ coastal plain using MODFLOW and MODPATH. Nitrate concentrations were simulated under three nitrate management scenarios: (1) a fixed input of nitrate at the current level, (2) a reduction of input at a constant rate, and (3) an immediate ban on nitrate input. (Ayers, 2000). Results are shown on Figure 3.4.4-2. The model predicted that changes in nitrate input to the aquifer system are clearly different under each scenario and that change in nitrate concentration of water discharging to streams and wells will be slow. The historical component of the model shows that nitrate in ground water and streams has been steadily increasing since the 1950's as land has been developed for agricultural and residential uses.

Under the fixed use scenario, the concentration of nitrate in water that is recharging ground water and streams stays the same as it is in the year 2000. This scenario was used to estimate the effects of constant inputs of nitrate. The model predicts that nitrate concentration in wells and streams will continue to rise through 2050 and only slowly begin to level off at a concentration equivalent to the fractions of urban, agricultural, and undeveloped land use in the area.

For the reduction scenario, the effect of reducing nitrate in recharge linearly to zero by 2050 was modeled. This scenario was used to estimate well and stream responses to management measures that gradually eliminate inputs of nitrate to recharge water by 2050. The model predicted that the nitrate concentration continue to increase for about 10 years in streams and for about 20 years in wells. This delay is equivalent to the average age of water discharging to streams and wells, respectively. Water discharging to wells which are screened near the bottom of the aquifer is older than the water entering streams. Therefore, streams have a larger proportion of younger ground water than wells and will respond faster. Under this scenario, nitrate concentrations were predicted to drop to near background levels by 2100.



**Figure 3.4.4-2: Response of Nitrate to Management Options in NJ Coastal Plain**  
Figure provided courtesy of LI-NJ NAWQA Program

For the total ban scenario, the effect of immediately reducing the nitrate concentration in recharge to zero was modeled. The model predicted that the concentration in ground-water discharge to streams will begin to decrease almost immediately as the result of the increasing influx of young, uncontaminated water (recharge concentration assumed to be zero). The decrease in nitrate concentration in wells and streams, however, will take several decades because some of the water entering these systems was recharged prior to the "ban" in year 2000.

For this Coastal Plain system, ground-water modeling strongly suggests that changes in chemical use or land management practices will take 1-2 decades before any substantial changes in wells and streams will be detected. Furthermore, the increase in nitrate use over the last decades is

likely to result in increasing nitrate concentrations in wells and streams because of the long residence time in the aquifer (about 10-20 years).

### **3.4.5 Strategies to Protect Potable Supplies: Nitrate**

Nitrate concentrations are of particular concern in the Passaic River Basin due to intensive water uses, particularly under record low stream flow stream conditions that were experienced in recent years. In October, 1999 the NJDEP's Division of Water Quality and Water Supply Administration retained a consultant to initiate a demonstration project concerning the potential to reduce the amount of nitrates discharged from wastewater treatment plants into the Passaic River. The project evaluated a technique known as On-Off Aeration. By periodically turning their aeration systems on and off the facilities were able to show significant reductions in the amount of nitrates discharged as well as reductions in energy usage. These results are being evaluated for a next phase to be tested this year.

The status and trends in nitrate concentrations will continued to be examined in detail in the Safe Drinking Water Program. In addition, sources of nitrate that may affect potable supplies will be identified and targeted for management in the Source Water Assessment Program.

### **3.4.6 Case Study: Tracking Down TCE Contamination in the Rahway River**

The following case study provides a discussion of how the Department is working to track down sources of an organic contaminant – tetrachloroethylene (TCE) in the Rahway River. The Rahway River is located in WMA07, in a urban/ industrial environment. United Water Company - Rahway operates a potable water supply intake withdrawing 5-6 million gallons per day from the lower portion of this river. See Figure A3.4.6-1 in the Appendix.

In order to protect public health, New Jersey's Safe Drinking Water regulations (N.J.A.C. 7:10) includes a Drinking Water Maximum Contaminant Level (MCL) for of 1 part per billion (1 ppb) for trichloroethylene (TCE). Due to elevated levels in finished drinking water, TCE contamination was identified in the river source water: a violation of the MCL for TCE occurred in January 1993. A packed column aeration treatment unit was approved in November 1993 to remove the TCE from finished drinking water. A granular activated carbon filter was also added to treat taste and odor. TCE data collected subsequent to the installation of additional treatment were below the MCL, indicating that the treatment is effective.

The source of TCE contamination in the river was not located in previous sampling efforts. However, an industrial area near Route 22 was identified as a suspected source area based on these results. The NJDEP Site Remediation Program (SRP) Division of Publicly Funded Site Remediation's Environmental Measurements and Site Assessment Section designed a sampling program in an effort to identify the source(s) contributing to the TCE contamination detected in the Rahway River. SRP collected water and sediment samples at 34 stations located between the intake at Rahway and Route 22 in Springfield Township on the Rahway River. Preliminary results from 22 stations indicate concentrations of about 2 ppb near the intake which increase up to 16 ppb approximately 8 miles up-river near Kenilworth Boulevard (RTE 509) in Cranford Township. Results from 12 more sites are pending. Sampling will include river reaches adjacent

to industrial areas that are suspected sources of TCE contamination. If one or more sources of TCE are found, clean-up will be a high-priority in the SRP since a drinking water supply is affected. Based on this assessment, drinking water designated uses are partially met in the Rahway River.